REMARKS

The present invention is a transmitter of a portable radio communication apparatus, an apparatus for a sub-harmonic mixer, and a sub-harmonic mixer. In accordance with the invention, a modulator produces outputs Pout and Nout. Ports RFP and RFN receive a baseband signal which is the information component to be broadcast by the radio carrier and a second port receives a local oscillator signal Lo for providing a conductance waveform at a multiple of the local oscillator signal which is twice the oscillator signal. A mixer comprised of transistors Q1 and Q4 mixes the baseband signal RFP and RFN with the conductance waveform at the multiple of the local oscillator signal Lo for up-converting the baseband signal to a radio frequency modulated carrier. The transmitter includes gain control CURRENT 1 and CURRENT 2 for controlling the gain of the modulator to control the output level of the modulator.

Claims 1-4 and 6 stand rejected under 35 U.S.C. §102 as being anticipated by United States Patent 5,552,734. The Examiner reasons as follows:

> As per claim 1, *Kimura* disclose a transmitter for a portable radio device comprising a modulator having a first port for inputting a base band signal and a second port for inputting a local oscillator signal; means for rectifying the input local oscillator signal to provide a conductance waveform at a multiple of the local oscillator signal; means for mixing the baseband signal with the conductance waveform at said multiple of the local oscillator signal frequency for up-converting the baseband signal to a radio frequency modulated carrier; and means for controlling the gain of the modulator thereby to control the output level of the modulator (see fig. 29-30, col. 18/ln. 12-col. 19/ln. 59).
>
> As per claim 2, *Kimura* disclose a local oscillator signal drives the switching means at a multiple of its frequency (abstract).

As per claim 3, *Kimura* disclose means for controlling the gain of the modulator comprises current control means (col. 18/ln. 12-col. 19/ln. 59).

As per claim 4, *Kimura* disclose the modular comprises two cross-coupled pairs of switching element wherein a signal input modulates the switching element at a multiple of the local oscillator frequency (col. 18/ln. 12-col. 19/ln. 59).

As per claim 6, *Kimura* disclose a sub-harmonic mixer comprising a first port for inputting a baseband signal to the switching means to be up-converted and a second port for inputting a local oscillator signal to drive the switching means at an even multiple of the local oscillator for up-converting the baseband signal to transmission frequency (see fig. 29-30, col. 18/ln. 12-col. 19/ln. 59).

These grounds of rejection are traversed for the following reasons.

Kimura discloses a local oscillator frequency multiplier and mixing circuit which utilizes a squaring circuit. The Examiner relies upon column 18, line 12 through column 19, line 59. This reliance is misplaced for the following reasons. The frequency multiplier and mixing circuit of Fig. 29 is not a transmitter for a portable radio communication apparatus, does not have a modulator having a first port for inputting a baseband signal and does not include means for mixing the baseband signal with the conductance waveform at said multiple of the local oscillator frequency for up-converting the baseband signal to a radio frequency modulator carrier as recited in independent claim 1.

The frequency multiplier and mixing circuit of Fig. 29 functions to mix a local oscillator signal V_{LO} to produce sum and difference frequencies of the local oscillator frequency f_{LO} centered around the radio frequency carrier V_{RF}. See column 20, lines 3-6 and column 21, lines 12-28. From the description therein, it is clear that the embodiment of Fig 29 and the other embodiments in Kimura operate to take a

local oscillator signal V_{LO}, which is not a baseband signal, double the local oscillator signal V_{LO} in frequency to $2f_{LO}$ which is then mixed with an RF carrier VRF to produce the aforementioned sum and difference frequencies. This operation does not meet claim 1 since the claimed mixing process involves mixing a baseband signal as recited by the means for mixing the baseband signal. Furthermore, there is no modulator having the claimed first port.

Since Kimura discloses a local oscillator signal V_{LO}, the Examiner has to interpret V_{LO} as the local oscillator signal and voltage V_{RF}, which is at radio carrier frequency, to be the baseband signal which, of course, is incorrect. Moreover, a person of ordinary skill in the art would not consider the local oscillator V_{LO} to be providing a baseband signal since the baseband signal is the information component which is up-converted. No information is conveyed by Kimura's local oscillator signal V_{LO}. For example, Newton's Telecom Dictionary, in the 18th Edition on page 89, defines baseband signalling as "[t]ransmission of a digital or analog signal at its original frequencies, i.e. a signal at its original form, not changed by modulation. This definition, which is typical of the meaning of baseband signal as understood by a person of ordinary skill in the art in the field of communications, is not properly interpreted in the context of claim 1 to cover either Kimura's local oscillator V_{LO} or the RF signal V_{RF} which are respectively inputs V_{LO} and V_{RF} in Fig. 29. Accordingly, it is submitted that claim 1 is not anticipated by Kimura.

Claim 2 recites that the local oscillator signal drives the modulator to switch at a multiple of a frequency of the local oscillator. This has no counterpart in Kimura for the reasons set forth above with regard to claim 1.

Claim 6 recites a sub-harmonic mixer, comprising: switching means, a first port for inputting a baseband signal to the switching means to be up-converted, and a second port for inputting the local oscillator signal to drive the switching means at an even multiple of the local oscillator frequency for up-converting the baseband signal to a transmission frequency. This subject matter is not anticipated or rendered obvious by Kimura for the reasons set forth above in that Kimura does not disclose the combination of switching means and a first port for inputting a baseband signal to the switching means to be up-converted to a transmission frequency. The combination of a baseband signal and local oscillator is not disclosed in Kimura.

Claim 5 stands rejected under 35 U.S.C. §103 as being unpatentable over Kimura in view of Hickman. Hickman has been cited for the disclosure of long tail pairs of bipolar transistors. The disclosure of long tail pairs of bipolar transistors by Hickman does not cure the deficiencies noted above with respect to Kimura. Accordingly, claim 5 is patentable.

The specification and claims have been amended to improve their form for reexamination.

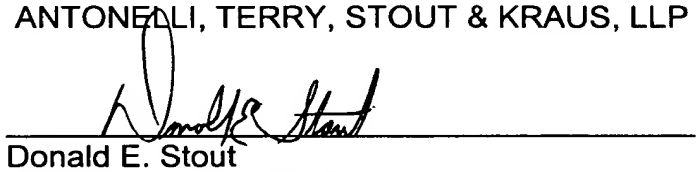
Newly submitted claims 7-12 define the invention in a different manner than claims 1-6. New claims 7-12 are also patentable for the reasons set forth above regarding claims 1 and 6.

In view of the foregoing amendments and remarks, it is submitted that each of the claims in the application is in condition for allowance. Accordingly, early allowance thereof is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (367.38669X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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MARKED VERSION ACCOMPANYING AMENDMENT

IN THE SPECIFICATION:

Please amend the specification as follows:

Please replace the first full paragraph appearing on Page 3 as follows:

A further concern with direct conversion transmitters is that the LO signal cannot be provided directly from a synthesiser locked VCO. There are two main reasons why. Firstly, if the radiotelephone has an internal antenna there is a very great risk that the transmitter will radiate back into the synthesiser locked VCO and cause it to go out of lock or generate spurious signals. Secondly, there will be insufficient isolation between antenna impedance (which will vary a great deal as the user moves around) and the synthesiser locked VCO. This will cause the synthesiser locked VCO to either go out of lock or generate spurious signals. One method of solving this problem is to create the LO signal by mixing together two synthesiser locked VCO signals and then filtering the LO to remove any unwanted mixing products. This however, increases component count and current consumption.

Please replace the last full paragraph appearing on Page 5 as follows:

~~Figure~~Fig. 1 is a schematic circuit diagram of a preferred embodiment in accordance with the present invention; and

Please replace the second full paragraph on Page 6 as follows:\

Detailed Description of the Invention

Referring initially to ~~Figure~~Fig. 1. there is shown an exemplary modulator circuit diagram of the present invention. In this circuit a suitable power supply is connected at V3v ie. 3 volts. The power supply V3v is connected to the output loads of the modulator circuit, the load being represented by resistors RI1 and RL2. These however may be reactive, resistive or active whichever is most suitable in the application. The output loads RL1 and RL2 are connected respectively to Pout and Nout which are the differential outputs of the modulator circuit. The signal present between Pout and Nout is the modulated radio frequency carrier. In the case of an 'I/Q' modulator this differential output would be summed with the differential output of a second modulator. The summed output would then be passed to the next stage of the transmitter.

Please replace the third (next to the last) full paragraph on Page 7 as follows:

The current controller operates to hold the total current through the Q1 ,Q2 and Q3,Q4 pairs constant, if the voltage on RFP and RFN is held constant for instance, the local oscillator signal on Lo as it becomes more positive will increase the current flow in Q2 and Q3 thus reducing the current flow in Q1 and Q4. When the local oscillator signal is lower in voltage than RFP and RFN, Q2 and Q3 will have much less current flowing in them than 01 and 04. When the local oscillator voltage is the same as RFP, Q1 and Q2 and also Q3 and Q4 will have the same current flowing in them. When the local

oscillator voltage is greater than the voltage on RFP and RFN Q2 and Q3 will have more current flowing in them than ~~Q3~~ Q1 and Q4.

Please replace the fourth (last) full paragraph on Page 7 as follows:

As shown in the embodiment of ~~Figure~~Fig. 1, the collectors of Q1 and Q3, Q2 and Q4 are connected together. Based on the description above, with RFP and RFN held at the same constant voltage, the current in Q1/Q4 will decrease at the same rate as the current in Q2/Q3 increases as the Lo voltage increases. Thus the voltage at Pout and Nout will remain constant. If the Local oscillator signal on Lo is larger in amplitude than Vbe i.e. 0.7 volts, it will completely switch Q2 and Q3 on and off. This is the desired mode of operation. The output pulses will then be of an amplitude defined solely by the amplitude of the differential signal applied between RFP and RFN and the gain defined by the current control means.

Please replace the second full paragraph on Page 8 as follows:

Referring to ~~Figure~~Fig. 2, this shows the operation of the sub-harmonic mixer with an input signal of 4.1MHz with an Lo of 2Mhz. This demonstrates its mode of operation.

Please replace the first full paragraph on Page 9 as follows:

Furthermore, each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features. In this regard, the invention includes any novel features or combination of features disclosed herein either explicitly

or any ~~generalisation~~ generalization thereof irrespective of whether or not it relates to the claimed invention or mitigates any or all of the problems addressed.

IN THE ABSTRACT:

The Abstract has been replaced as follows:

ABSTRACT

A transmitter for a portable radio communication apparatus comprising a modulator having first port for inputting a baseband signal and a second port for inputting a local oscillator signal, and including means for rectifying the input local oscillator signal to provide a conductance waveform at a multiple of the local oscillator signal, and means for mixing the baseband signal with the conductance waveform at said multiple of the local oscillator signal frequency for up-converting the baseband signal to a radio frequency modulated carrier, the transmitter including means for controlling the gain of the modulator thereby to control the output level of the modulator.

~~Figure 1~~

IN THE CLAIMS:

Claims 2 and 6 are amended as follows:

2. (Amended) A transmitter according to claim 1, wherein a local oscillator signal drives the ~~switching means~~ modulator at a multiple of its frequency.

6. (Amended) ~~Apparatus for~~ An apparatus in a sub-harmonic mixer, comprising switching means, a first port for inputting a baseband signal to the switching means to be upconverted, and a second port for inputting a local oscillator signal to drive the switching means at an even multiple of the local oscillator frequency for upconverting the baseband signal to transmission frequency.